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AUTHOR	Geist, John E.
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ABSTRACT

This booklet, one of a series developed by the Frederick County Board of Education, Frederick, Maryland, provides an instruction module for an individualized or flexible approach to 7th, 8th, and 9th grade science teaching. Subjects and activities in this series of booklets are designed to supplement a basic curriculum or to form a total curriculum, and relate to practical process oriented science instruction rather than theory or module building. Included in each booklet is a student section with an introduction, performance objectives, and science activities which can be performed individually or as a class, and a teacher section containing notes on the science activities, resource lists, and references. This booklet presents an introduction to the study of space, rockets, and space flight. The estimated time for completing the activities in this module is 2-3 weeks. (SL)

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MINI-COURSE UNITS

BOARD OF EDUCATION OF FREDERICK COUNTY

1973

SE 021 651

Frederick County Board of Education

Mini Courses for

Life, Earth, and Physical Sciences

Grades 7, 8, and 9

Committee Members

Life Science	-	Terrence Best Paul Cook Sharon Sheffield Melvin Whitfield
Earth Science	-	Nelson Ford John Fradiska John Geist
Physical Science	-	Ross Foltz Kenneth Howard Fred Meyers

Dr. Alfred Thackston, Jr.
Assistant Superintendent for Instruction

Marvin Spencer
Science Supervisor

Frederick, Maryland

1973

FOREWORD

The contents represented in these modules of instruction, called mini courses, is an indication of our sincere desire to provide a more individualized and flexible approach to the teaching of science.

Data was accumulated during the school year relative to topics in life, earth, and physical science that were felt to be of greatest benefit to students. The final selection of topics for the development of these courses during the workshop was made from this information.

It is my hope that these short courses will be a vital aid in providing a more interesting and relevant science program for all middle and junior high school students.

Dr. Alfred Thackston, Jr.
Assistant Superintendent for Instruction

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Mrs. Helen Shaffer, Printing Technician
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SPACE AND ITS PROBLEMS

Prepared by

John E. Geist

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Estimated Teaching Time

2-3 weeks

SPACE AND ITS PROBLEMS

INTRODUCTION:

It is interesting to note that the study of space and rockets began many, many years ago. Actually, it began when man first looked up at the night sky. You might be wondering who the first people were and who launched the first rockets, or how did America's space program develop? The nature of the space environment is ..., well, what is it like? Why does it cause so many, many problems for man? Can you list some of these problems? Which one would you consider the most important? Why?

Controlled flight began with the first airplane; however, something much more powerful was needed to escape from earth's gravity. Thus you can understand why scientists designed rockets. What is a rocket? What makes them go? Why were different kinds of rockets built? What is multi-staged rockets? In discovering the answers to these questions, you will find that there have been many manned and unmanned space flights and moon landings. Do you understand the goals of these missions? Can you name our first astronaut and the first man ever to set foot on the moon?

Some people say that we're living in the "space era". Some people said man would never land on the moon. Now that men have been there, you should be wondering what's next? What planet will be explored next? What will future space craft look like? Let's see what we can learn about this space age we are living in.

GENERAL OBJECTIVES FOR THIS UNIT:

After completing this unit you will have a(an):

1. better understanding of space, rockets, and the man in space program.
2. appreciation for the pioneers in space exploration and rocketry.
3. desire to keep informed about future space flights.

TOPICS:

I. When Did it all Begin?

A. Objectives

Students will:

1. identify and explain the first rocket launchings.
2. list pioneers and their contributions to the space program.
3. identify the major developments in space exploration.

B. Activities

1. Reading assignments: use one or more texts to help complete the above objectives.

   Pathways Book 3, Unit IV, Chapter 1
   Earth Science: The World We Live In, 1965, Chapter 26, p. 365
   1969, Chapter 28, p. 426
   Modern Earth Science, 1969, Chapter 1, p. 2
   The Earth, Its Changing Form, 1970, Chapter 20, pp. 520-523

2. View film: Story of Space Age: Dr. Goddard to Project Gemini
3. Research: Write a report on one of the topics listed below. You may do another one and it will count extra credit.
   a. Dr. Goddard
   b. Wan Hu (1500's)
   c. Hot air or gas balloons
   d. Wright Brothers or Kitty Hawk
   e. Germany's V-2 rocket
   f. I.G.Y. space probes
   g. Sputnik I
4. Construct a time-line tracing the major events which occurred as space exploration developed.

II. Why is Space a Problem?

A. Objectives

Students will:

1. describe the nature of the space environment.
2. identify and list some medical problems man encounters in space.
3. identify and list some mechanical problems man encounters in space.

B. Activities

1. Reading Assignment: use one or more texts to help complete the above objectives.
   Pathways Book 3, Unit IV, Chapter 2
   Earth Science: The World We Live In, 1965, Chapt. 26, pp. 376-378 & 365-372
   1969, Chapt. 28, pp. 438-440 & 426-434
   Modern Earth Science, 1969, Chapter 5, pp.108-110
2. Do experiments 4 and 5 in Rockets (obtain from the teacher).
3. Observe: Filmloop titled Experimental Weightlessness
   or
   Filmstrip: Conditions in Space, Space Flight, Part 1, Physical Problems
   Space Flight, Part 2, Human Problems
   or
   Study Prints: Building toward the Moon
   or
   Film: Gravity, Weight and Weightlessness, F559
4. Research: Write a report on one of the following topics. You may do another one and it will count extra credit.
   a. weightlessness
   b. vacuum
   c. g-forces
   d. Newton
   e. eating food in space
   f. materials for construction of space crafts
   g. excursion 7-2 in Silver Burdette's Environmental Science, ISCS

III. How Do We Get to Space?

A. Objectives

Students will:

1. explain the action and reaction principle.
2. distinguish between a solid fuel and liquid fuel propulsion system.
3. describe the launch site complex (identify features and structures).
4. explain the launch from countdown to splashdown.

B. Activities

1. Experiment with a balloon. Explain why it goes when you blow it up and let go.
2. Do experiment 2 in Rockets.
3. Construct a diagram (and label it) of the solid fuel chamber and the liquid fuel chamber. (Use a text or recommended study print.)
4. List and describe features at the launch site complex. (Use text or recommended study print.)
5. Observe study prints titled Countdown to Splashdown and explain the sequence of events during a launch.
6. Reading assignment: use one or more texts to help complete the above objectives.
   Pathways Book 3, Unit 4, Chapters 3-4
   Earth Science: The World We Live In, 1965, Chap. 26, p. 366, 372-374
   1969, Chap. 28, p. 427, 434-436
   Modern Earth Science, 1969, Chapter 5, pp. 98-100
   The Earth: Its Changing Form, 1970, Chapter 20, pp. 520-523
7. Research: Write a report on one of the following topics. You may do another one for extra credit.
   a. Assembly of a rocket at Cape Kennedy
   b. Saturn V rocket (include a diagram)
   c. Staging
   d. Assemble and launch your own rocket (see Estes catalogue)
   e. Thrust

IV. They Said We Would Never Put a Man in Space!

A. Objectives

Students will:

1. name the pioneer astronauts.
2. identify the major manned space programs.
3. construct a diagram and explain the most important steps in a manned trip to the moon and back.
4. explain the astronauts preparation for the space flights.

B. Activities

1. Reading assignment: use one or more texts to help in completing the above objectives.
   Pathways Book 3, Unit 4, Chapter 5
   Earth Science: The World We Live In, 1965, Chapt. 26, pp. 379-384
   1969, Chapt. 28, pp. 442-443
   Modern Earth Science, 1969, Chapter 5
   The Earth: Its Changing Form, 1970, Chapter 21

2. Observe transparencies from the set titled "Space Travel"
   or
   study prints from the set titled "Space Travel"
   or
   film: Eagle has Landed: Apollo 11, F846
3. Filmstrip: Man in Space or Man's Preparation for Space Travel
4. Use of study print titled "Astronauts - Training and Equipment"
5. Research: Write a report on one of the following topics. You may do another one for extra credit.
   a. Food preparation for the astronauts
   b. The space suit
   c. The Rover
   d. Personality of individual astronauts
   e. Psychology of being in space

V. Out of Sight! What's That?

A. Objectives

Students will:

1. list the purposes of orbiting unmanned satellites.
2. identify common satellites with their programs.
3. diagram and explain the orbits of satellites.

B. Activities

1. Reading assignment

   Pathways Book 3, Unit 4, Chapter 5
   Earth Science: The World We Live In, 1965, Chapt. 26, pp. 378-379
   1969, Chapt. 28, pp. 441-443
   Modern Earth Science, 1969, Chapter 5
   The Earth: Its Changing Form, Chapter 20, pp. 537-544

2. Use transparencies from set titled "Space Travel"
   or
   filmstrip titled "Information from Satellites"
   or
   film: Space Satellites
3. Work lab - Orbiting of a Man-made Satellite (obtain lab pages from your teacher)
4. Research: Write a report on one of the following topics. You may do another for extra credit.
   a. Echo I
   b. Tiros
   c. Vanguard I
   d. Sputnik I
   e. Solar cells
   f. Where satellites are made
   g. Nimbus
   h. Orbiting astronomical observatory

VI. What's Next?

A. Objectives

Students will:

1. identify several future space missions and explain their goals.
2. design a futuristic spacecraft or space station.
3. compose or tell a short story about traveling in space.

B. Activities

1. Read "Space Shuttle" by NASA.
2. Write to NASA for information on this topic.
3. Research one of these topics
   a. Sky Lab
   b. Space stations
4. Design a spacecraft or space station.
5. Contest idea: See who can compose the most original space story.

All of the audio-visuals are available at the IMC. It is suggested that the teacher evaluate and use these materials when he feels they are most appropriate. Other materials are available at the IMC.

This unit was modified for use with several earth science texts; however, other books do have chapters which can be used with these objectives in mind. Included are two folders which are used. You may wish to order some of these. Also included here is a copy of the lab titled, "Orbiting a Man-made Satellite". Short class discussions following each section of this course are recommended.

A sample quiz is provided for your use; however, it is suggested that the teacher determine his evaluation.

Resources:

Pathways, Book 3 by Globe Publishing Company, 1970

Earth Science: The World We Live In, by Namowitz and Stone, Van Nostrand Company, 1965 and 1969

Modern Earth Science, by Ramsey and Buckley, Holt, Rinehart & Winston Co., 1969

The Earth: Its Changing Form, by Brandwein, et al, Harcourt, Brace Jovanovich Co., 1970

Quiz on Space Travel

Name_____

Period_____

Match the satellite with its mission.

1. Sputnik I	_____	A. First American satellite; 1958; Discovered Van Allen radiation belt
2. Sputnik II	_____	B. Will orbit earth for centuries, solar powered
3. Explorer I	_____	C. Provides communications for vessels at sea
4. Vanguard I	_____	D. First man-made satellite (Russian)
5. Pioneer	_____	E. First to return to earth intact
6. Discoverer	_____	F. First satellite to carry a living thing
7. Tiros	_____	G. Explores the planets
8. Comsat	_____	H. Orbits the sun and radios information to earth about outer space
9. Transit	_____	I. Photographs the moon's surface
10. Ranger	_____	J. Communications satellite
11. Mariner	_____	K. Weather satellite, photographs clouds
		L. Two-manned mission to the moon

Match the definition with the correct term.

_____12. Newton's law, which explains rocket thrust.	A. friction
_____13. The shape of a man-made satellite's orbit.	B. multi-stage rocket
_____14. Air resistance	C. apogee
_____15. weightlessness	D. satellite
_____16. needed to put satellites into orbit.	E. ellipse
_____17. A body in space revolving around another body.	F. condition of Og's
	G. gravity
_____18. A force which counteracts inertia to keep a body traveling in orbit rather than in a straight line out into space.	H. for every action there is an equal and opposite reaction
_____19. part of an orbit farthest from the earth.	I. perigee
_____20. used to slow down a rocket or to change its direction.	J. retrorockets
	K. spacecraft

Name..... Class..... Date.....

LAB: ORBIT OF A MAN-MADE SATELLITE

Purpose: To construct a diagram that will help us to understand some important features of satellite orbits.

Background: The orbits of man-made earth satellites, like the orbits of the natural moons, planets, and comets of the solar system, are elliptical. As such, their distances from the earth and speed of revolution change steadily through each revolution around the earth. The point at which the satellite approaches closest to the earth is its **perigee** (**peri,** near, **gee,** earth). The point at which the satellite is farthest from the earth is its **apogee** (**apo,** away). These words are comparable to the words **perihelion** and **aphelion** used in connection with orbits around the sun.

In this exercise we shall construct and study a scale diagram of the orbits of **Vanguard I, Echo I** (the balloon satellite), and **Satellite X** (an imaginary satellite with a circular orbit).

Materials: 1) Unlined white paper, 8 1/2 × 11" 2) ruler 3) compass

Approximate Distances of Satellite from Earth's Surface

Name	Apogee		Perigee	
	Miles	*Inches**	*Miles*	*Inches**
Vanguard I	2500		400	
Echo I	1200		1000	
Satellite X	4000		4000	

* Scale: ¼ inch = 500 miles.

PROCEDURE

The Earth

1) Using a scale of 1 inch to 2000 miles (1/4 inch = 500 miles), describe a circle at the center of your paper to represent the earth. Assume a radius of 4000 miles for the earth. Place arrows at left and right sides of the earth to show its counterclockwise rotation.

The Sun

2) Hold the paper with long edge from left to right. At the left edge, draw horizontal arrows 2 inches long and 1 inch apart, (starting at the center of the edge) to represent sun's rays. Label them.

The Earth's Shadow

3) Divide the earth in half by a vertical diameter (twilight line) through its center. From the ends of the diameter, draw horizontal lines to the right edge of the paper to mark off the earth's shadow. Lightly shade the night half of the earth and its shadow. Just inside the earth, label Noon, Sunset, Midnight, and Sunrise at the proper points.

Orbit of Vanguard I

4) Using the scale indicated, place a dot to the right of the earth to show Vanguard's apogee distance from the surface, and another dot to the left of the earth to show Vanguard's perigee distance. Above and below the earth place dots at the **average** of the two distances. Join these four dots by hand with a smooth ellipse. (The ellipse should approach the earth's surface gradually from apogee to perigee.) Label the ellipse "Orbit of *Vanguard I*."

Orbit of Echo I

5) Plot the orbit of Echo I in the same way as you did that of Vanguard. Draw the orbit in red crayon, or by a broken line. Label it "Orbit of *Echo I*."

The Orbit of Satellite X

6) Since this is circular, it may be drawn with your compass. Label it "Orbit of *Satellite X*."

Visibility of the Satellites: Vanguard I

7) Extend the vertical diameter through the earth's center all the way to Echo's orbit.

a) Draw a small circle with antennae to represent Vanguard I in the middle of the sunlight side of its orbit. Why can't it be seen from the earth at this time (in daylight)?.....

.....

To the left of its orbit, print "Invisible in Bright Sunlight."

b) Place Vanguard in the middle of the right side of its orbit. Why can't it be seen from the earth at that time?.....

.....

In the shadow, print "Eclipsed by Earth's Shadow."

c) Place Vanguard in the parts of its orbit between the earth's shadow and its twilight line. Why can Vanguard be seen here, at either dawn or dusk?.....

.....

.....

.....

Print "Visible at Dawn" and "Visible at Dusk" in the proper places.

Visibility of the Satellites: Echo I

8) Draw small circles at the same relative points in Echo's orbit as you did for Vanguard. Compare the extent to which Echo is: **a**) eclipsed by the earth's shadow, as compared with Vanguard.....

.....

Name ..... Class..... Date.....

b) visible at dawn or dusk, as compared with Vanguard.....

.....

c) visible at night .....

.....

d) visible by day.....

.....

9) *Vanguard I* is less than 2 feet in diameter. *Echo I*, the balloon satellite, is 100 feet in diameter. How do these dimensions affect their relative visibility, considering their orbits?

.....

10) *Visibility of Satellite X.* How does the greater distance of Satellite X from the earth affect its visibility, as compared with *Vanguard* and *Echo*?.....

.....

.....

.....

Visibility of the Moon

11) Why is our natural moon affected so little by the earth's shadow that it is eclipsed only a few times a year?.....

.....

.....

A Satellite's Period of Revolution

12) *Vanguard* revolves around the earth about once every two hours. How does this affect its visibility from the standpoint of a) duration at any one time.....

.....

b) different places on the earth.....

.....

Evaluation Form for Teachers

1. Name of the mini course _____

2. Was this unit appropriate to the level of your students?

3. Explain how this mini course was used with your students. (Individual, small group, or total class)

4. Identify the plus factors for this course.

5. List the changes that you would recommend for improvement.

7. Did you use any other valuable resources in teaching this unit? If so, please list.

PLEASE RETURN TO SCIENCE SUPERVISOR'S OFFICE AS SOON AS YOU COMPLETE THE COURSE.

ADDITIONAL SCIENCE MINI-COURSES

LIFE SCIENCE	Prepared by
A Study for the Birds	Terrence Best
Creepy Critters (Snakes)	Terrence Best
How's Your Plumbing?	Paul Cook
Guess Who's Been Here for Dinner	Paul Cook
Plants - The "Other" Living Things	Sharon Sheffield
Let's Look at You - The Human Organism	Sharon Sheffield
Classification: Why is There a Need?	Melvin Whitfield
Protist: The "Unseen" Kingdom	Melvin Whitfield

EARTH SCIENCE	
Coastline Development	Nelson Ford
Ocean Currents	John Fradiska
Features of the Ocean Floor (Ocean Floor Topography)	John Fradiska
Space and Its Problems	John Geist
Invertebrate Fossils: Clues to the Distant Past	John Geist
An Attempt towards Independent Study in Astronomy	John Geist

PHYSICAL SCIENCE	
Household Chemistry	Ross Foltz
Notions on Motions	Kenneth Howard
Environmental Chemistry	Fred Meyers